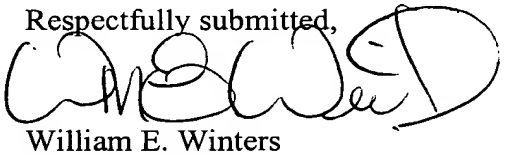
CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 415-576-0200.

Respectfully submitted,



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SF 1215305 v1

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Paragraph beginning at line 2 of page 3 has been amended as follows:

The present invention provides a trench transistor with a source that is self-aligned to the gate. A self-aligned source is a source that has been implanted such that a gate material, which is in a trench and separated from the substrate by a gate dielectric layer, acts as an implantation mask during the source implantation step. A self-aligned source therefore has been at least partially implanted through a sidewall of the trench. In one embodiment a gate-source overlap results from an angled implantation step that implants source dopant beneath a portion of the gate. After implanting one edge of a trench, the substrate may be rotated ~~180~~ 90 degrees to implant the other edge of the trench without breaking vacuum or removing the substrate from the ion implanter. The angled implant can provide a consistent, low gate-to-source capacitance, thus resulting in a more uniform and predictable device with lower parasitic capacitance than conventional devices. The angled implant also allows the gate-source overlap to be formed without relying on diffusing source dopant into the substrate, which would otherwise compensate the heavy body dose and reduce the effectiveness of the heavy body. The angle of the implant can be varied to control the relative doping concentration between an active source region and a source contact region. In one embodiment, arsenic ("As") is implanted to form an n+ source region because of the relatively low diffusivity of As in silicon, thus forming an "L-shaped" source region with a distinct interior corner that the heavy body can extend into to enhance ruggedness of the device.

IN THE CLAIMS:

Claims 1, 3, 7 and 9 have been amended as follows:

1. (Twice Amended) A trench transistor comprising:

a substrate having a surface;

a trench extending a selected depth into the substrate from the surface, the trench having a sidewall;

a gate structure at least partially within the trench; ~~and~~

a source contact region extending a selected distance into the substrate from the surface; and

a source region self-aligned to the gate.

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wherein the source region forms a p-n junction in the substrate, a distance of the source p-n junction from the sidewall being approximately equal to the distance of the extension of the source contact region from the surface.

3. (Once Amended) The trench transistor of claim 2 wherein ~~a gate-to-source capacitance arises from~~ the degree of overlap ~~between the gate structure and the source region, the~~ is controlled during the manufacture of the transistor so as to provide a predetermined gate-to-source capacitance ~~being selected according to the overlap~~.

7. (Once Amended) The trench transistor of claim ~~5~~ 1 wherein both the distance of the source p-n junction from the sidewall and the distance of the extension of the source contact region from the surface is less than or equal to about 0.15 microns.

9. (Once Amended) The trench transistor of claim ~~6~~ 1 further comprising a heavy body, the heavy body extending into the inner corner formed by the source region and the source contact region.

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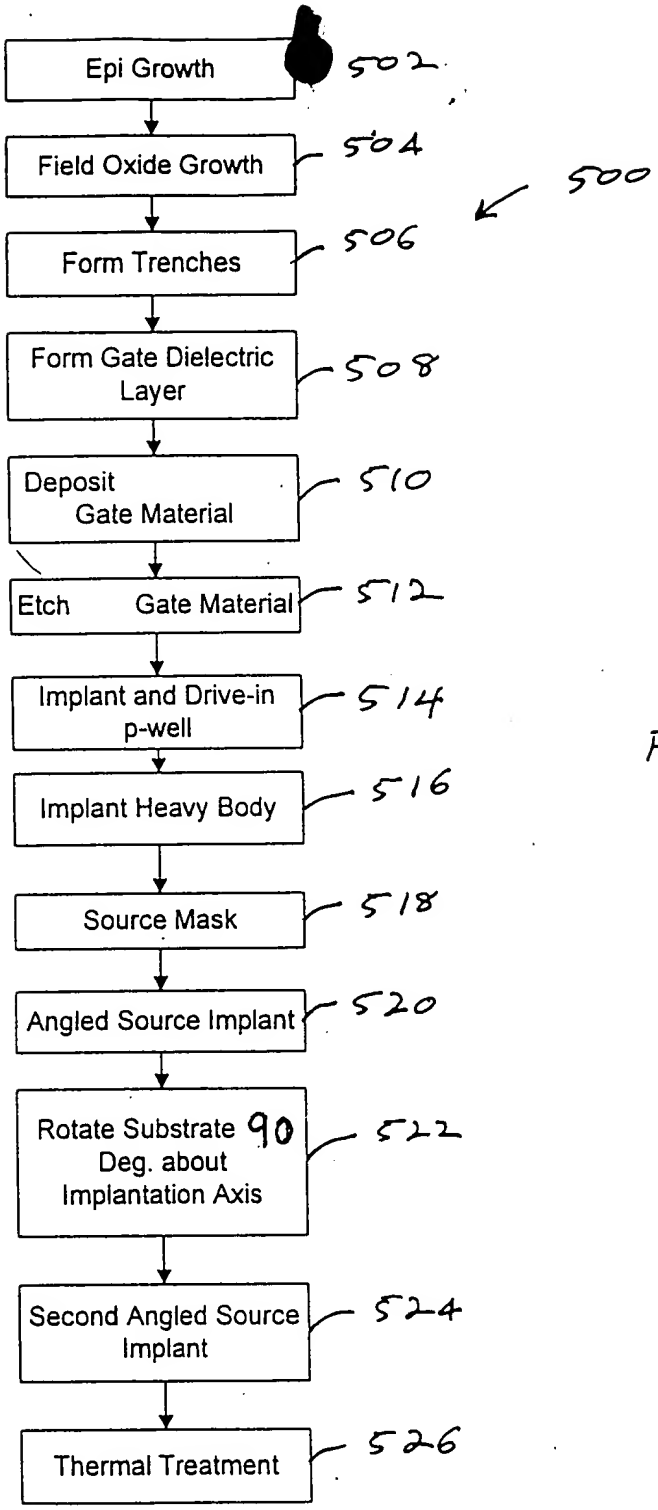
Epi Growth
502
Field Oxide Growth
504
500
Form Trenches
506
Form Gate Dielectric Layer
508
Deposit Gate Material
510
Etch Gate Material
512
Implant and Drive-in p-well
514
Implant Heavy Body
516
Source Mask
518
Angled Source Implant
520
Rotate Substrate 90 Deg. about Implantation Axis
522
Second Angled Source Implant
524
Thermal Treatment
526

FIG. 5.

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